INTRAOCULAR LENS IMPLANT AND METHOD OF LOCATING AND ADHERING WITHIN THE POSTERIOR CHAMBER

BACKGROUND OF THE INVENTION

This invention relates generally to intraocular lenses (IOLs) for implant in the human eye and more specifically to an IOL for implantation in the posterior chamber after an extracapsular cataract extraction (ECE) where the IOL will adhere to the wall of the posterior chamber, i.e. the posterior capsule, by means of an adhesive, either a biological adhesive, or a nonbiological adhesive, and wherein the IOL will prevent the central migration of lens epithelium or other biological contaminents to and within the space between the IOL and the posterior capsule, while simultaneously retaining the lens in its affixed position, and prevent it from migration.

In 1949, the first IOL implants were performed using the Ridley lens. The Ridley lens was held in place by scarring it to the lens capsule and iris. However, it did not remain stable within the eye, as implanted, and further induced corneal dystrophy, glaucoma, and hemorrhaging. It was therefore soon abandoned and replaced by anterior chamber IOLs. The first anterior chamber IOLs were held in place by seating rigid (Strampelli lens, 1953) or by flexible (Danheim lens, 1955) positioning loops in the angle of the anterior chamber. The Strampelli rigid support lens caused corneal dystrophy and had inadequate fixation means which led to epithelial cell loss. The concept, was therefore abandoned. The Danheim lens' fixation loops haptics were made from nylon and were therefore subject to biodegradation in the eye. But, it too was soon abandoned as a concept for this type of implantation.

The problems associated with seating the haptics in the angle of the anterior chamber was addressed by turning to the iris itself for support. The earliest such lens was Epstein's "collar stud" lens which resembled a shirt's stud. It had frequent problems with dislocation due to its extreme weight. Epstein then designed his "Maltese Cross" lens which had four bracing haptics, or loops. Two of the loops were seated behind the iris, while the other two were seated in front of the same.

In 1957, Binkhorst designed his iris clip lens. The original design had four positioning loops—two "L" shaped loops protruded from the back of the lens and were seated behind the iris when inserted, once the other two loops projected from the side of the lens, coplaner with the bottom of the lens, and were seated in front of the iris. Binkhorst further designed a two loop lens and a cloverleaf lens to overcome the problems of dislocation and corneal decompensation associated with the original four loop designs. A number of inventors modified the Brinkhorst lens. For example, Krasnov used sutures to keep the lens fixed, as identified in U.S. Pat. No. 3,986,214. Flom utilized posts which projected rearwardly from the back of the lens, and which penetrated the iris, as shown in U.S. Pat. No. 3,991,426. Furthermore, Barnet utilized magnetic attraction to position the lens by placing magnets at the end of the loops on either side of the iris, as shown in his U.S. Pat. No. 4,298,996. In 1973, Worst designed his medallion lens, which had loops at the approximately three and nine o'clock positions, and a rim around the optical portion and which was sutured to the peripheral structure of the iris.

Early on, lenses had been designed for locating within the posterior chamber. In the mid-1950's Barraquer deigned a lens having incomplete, S-shaped, polypropylene loops which were to be seated in the capsular bag after an ECE. In 1975, Shearing designed a similar lens which also utilized flexibly incomplete loops to position the lens, as shown in his U.S. Pat. No. 4,159,546. Furthermore, the Shearing lens, like the Brinkhorst lens, had many modifications to it, to improve its ability to remain in position, once installed and located. The modifications included the altering of its configuration, size, and number of loops, or through the replacing of the loops with sets of straight pliant hairs, as can be seen in the Hoffer U.S. Pat. No. 4,244,060.

Many of these lenses developed opacified posterior capsules after implantation, and were generally unstable to varying degrees within the eye, once installed, or were damaging to the iris during implantation.

Opacification of the posterior capsule is due to the central migration of lens epithelium which could not be completely removed when the natural lens was removed. The epithelial cells migrate to the space between the implanted IOL and the posterior capsule of the eye. If they proliferate and create new lens fibers then "epithelial pearls" are formed. Some of the cells may metamorphose into myofibroplasts, which gives rise to connective tissue and create what is known as "fibrosis of the posterior capsule." These pearls and/or fibrosis impede and may eventually completely obstruct vision, requiring YAG laser treatment, or discission to restore the clarity. This problem has previously been addressed by Hoffer in his '060 patent, as explained above. Hoffer incorporated, as an integral part of the IOL, an annular lip or ridge which was implaced at the outer periphery of the lens and protruded rearwardly therefrom to the posterior surface of the eye cavity. The ridge, however, was not continuous. It had one or two openings to allow for the insertion of an ophthalmic instrument to perform a discission, a procedure required by IOL opacification due to the presence of such opacification. Because the ridge was not continuous, since the lens does not sit tightly against the posterior capsule and because lens epithelium can migrate, as shown in lab studies, under the ridge, the Hoffer lens is still subject to the formation of pearls and fibrosis after any prolonged usage.

Many posterior chamber lenses use polypropylene, or polymethyl methacrylate, a flexible and memory retaining material, for their positioning hairs or loops ("haptics") that are structured onto the lens, for fixation purposes. After a period of time, though, the memory retaining ability of the haptics may be lost, at which time, the IOLs have a tendency to decenter. Further, implanting lenses with protruding fixation means can damage the Uveal tissue if the haptics are not inserted into the capsular bag. Damage can occur if the haptics are passed through the pupil to be seated in the saddle or cul-de-sac of the posterior chamber. (The ciliary sulcus.) Kelman, in his U.S. Pat. No. 4,534,069, addressed this problem by securing the positioning means in a contracted position around the IOL using a soluble coating. When the lens is inserted through the pupil, the hairs, or loops, then do not damage the iris. Once inside the posterior chamber, the coating dissolves and the positioning means extend to seat themselves in the posterior chamber cul-de-sac. This method, however, re-